

CLAIMS

We claim:

1 1. A method of geophysical exploration of a subsurface region of interest, comprising:
2 utilizing an unsupervised learning network to organize seismic data representing a
3 subsurface region of interest;
4 correlating a portion of said organized seismic data with lithological data from a
5 well bore located in said subsurface region of interest; and
6 applying said correlation to said seismic data to estimate lithology in said subsurface
7 region of interest.

1 2. The method of claim 1 wherein said unsupervised learning network is a self
2 organizing feature map.

1 3. The method of claim 1 wherein said unsupervised learning network is a Kohonen
2 network.

1 4. A method of geophysical exploration of a subsurface region of interest, comprising:
2 applying a plurality of seismic data attributes for measurement location from a
3 seismic data set from a subsurface region of interest to a Kohonen network to organize said
4 seismic data set into a plurality of seismic Kohonen classes;
5 selecting a subset of said organized seismic data set representative of the earth's
6 subsurface in the vicinity of a well bore penetrating said subsurface region of interest;
7 correlating Kohonen classes of said subset of said organized seismic data set with
8 classes of lithological data from said well bore to generate a correlation between Kohonen
9 classes and lithological classes; and
10 applying said correlation to said seismic data set to estimate lithology of said
11 measurement locations.

1 5 The method of claim 4 wherein said seismic data attributes comprise semblance,
2 amplitude-versus-offset and attenuation.

1 6. The method of claim 4 wherein said lithological data comprise volume shale and
2 acoustic impedance.

1 7. A method of geophysical exploration of a subsurface region of interest, comprising:
2 applying a plurality of lithology values for measurement location from a well bore
3 penetrating a subsurface region of interest to a Kohonen neural network to organize said
4 lithology values into a plurality of lithology Kohonen classes;
5 utilizing said lithology Kohonen classes to establish ranges of a lithology value;
6 applying a plurality of seismic data attributes for measurement location from a
7 seismic data set from said subsurface region of interest to a Kohonen network to organize
8 said seismic data set into a plurality of seismic Kohonen classes;
9 selecting a subset of said organized seismic data set representative of the earth's
10 surface in the vicinity of said well bore penetrating said subsurface region of interest;
11 correlating Kohonen classes of said subset of said organized seismic data set with
12 classes of lithological data from said well bore to generate a correlation between Kohonen
13 classes and lithological classes, wherein said ranges of a lithology value are utilized in
14 establishing boundaries of said lithology classes; and
15 applying said correlation to said seismic data set to estimate lithology of said
16 measurement locations from said subsurface region of interest.

1 8. The method of claim 7 wherein said lithology values are volume shale and acoustic
2 impedance.

1 9 The method of claim 7 wherein said seismic data attributes comprise semblance,
2 amplitude-versus-offset and attenuation.

10. A device which is readable by a digital computer having instructions defining the following process and instructions to the computer to perform said process:

- utilizing an unsupervised learning network to organize seismic data representing a subsurface region of interest;
- correlating a portion of said organized seismic data with lithological data from a well bore located in said subsurface region of interest; and
- applying said correlation to said seismic data to estimate lithology in said subsurface region of interest.

11. A device which is readable by a digital computer having instructions defining the following process and instructions to the computer to perform said process:

- applying a plurality of seismic data attributes for measurement location from a seismic data set from a subsurface region of interest to a Kohonen network to organize said seismic data set into a plurality of seismic Kohonen classes;
- selecting a subset of said organized seismic data set representative of the earth's subsurface in the vicinity of a well bore penetrating said subsurface region of interest;
- correlating Kohonen classes of said subset of said organized seismic data set with classes of lithological data from said well bore to generate a correlation between Kohonen classes and lithological classes; and
- applying said correlation to said seismic data set to estimate lithology of said measurement locations.

12. A device which is readable by a digital computer having instructions defining the following process and instructions to the computer to perform said process:

- applying a plurality of lithology values for measurement location from a well bore penetrating a subsurface region of interest to a Kohonen neural network to organize said lithology values into a plurality of lithology Kohonen classes;
- utilizing said lithology Kohonen classes to establish ranges of a lithology value;

7 applying a plurality of seismic data attributes for measurement location from a
8 seismic data set from said subsurface region of interest to a Kohonen network to organize
9 said seismic data set into a plurality of seismic Kohonen classes;

10 selecting a subset of said organized seismic data set representative of the earth's
11 surface in the vicinity of said well bore penetrating said subsurface region of interest;

12 correlating Kohonen classes of said subset of said organized seismic data set with
13 classes of lithological data from said well bore to generate a correlation between Kohonen
14 classes and lithological classes, wherein said ranges of a lithology value are utilized in
15 establishing boundaries of said lithology classes; and

16 applying said correlation to said seismic data set to estimate lithology of said
17 measurement locations from said subsurface region of interest.